REMARKS/ARGUMENTS

Claims 1-13, as amended, remain in this application. Claims 3-8 and 11-13 were indicated to be allowable but objected to as dependent from a rejected claim. These claims have been re-written in independent form and are now in condition for allowance.

Claims 1 and 2 were rejected under 35 U.S.C. §102 and claims 9 and 10 were rejected under §103 as being unpatentable over a paper published by Liu et al. The Liu paper was published from the same group at California Institute of Technology which includes the inventors in this application. Note, for example, that a co-author is William Johnson who is a co-inventor in this application.

Claim 1 has been amended to clearly point out that this invention involves a ductile reinforced composite metal object having an amorphous metal matrix and a second ductile metal phase embedded in the matrix formed by in situ crystallization from a melt. An exemplary composite is formed from a melt including principally zirconium and titanium with copper, nickel, beryllium and niobium, for example. The amorphous metal phase and the composite material formed from this kind of a melt are ductile.

The Liu paper describes a family of bulk metallic glasses in the ternary system of magnesium, copper and yttrium. The paper describes precipitation of nanocrystals in the amorphous phase when more than six percent of lithium is added. When the lithium content is higher than 6% the solid alloys are partially amorphous and partially crystalline. When the lithium content is about 10% or less there is a single crystal phase identified as Mg_7Li_3. An alloy with 15% lithium has several crystalline phases.

What is not mentioned in the Liu paper is that the composite material is not ductile. Nor is it mentioned that the Mg-Cu-Y alloy matrix is not ductile. No compositions in the Mg-Cu-Y system have been found to be ductile.

A measure of ductility is the fracture toughness of a material. Exemplary units for fracture toughness are megapascals-$m^{1/2}$. This is in effect a measure of the ability to resist cracking. Ordinary window glass may have a fracture toughness of around 1 to 3 (megapascals-

$m^{1/2}$). Typical steel has a fracture toughness in the order of 70-100. An exemplary aircraft aluminum or titanium alloy may have a fracture toughness of around 30. Amorphous matrix composite. A good amorphous alloy in the Zr-Ti-Cu-Ni-Be system has a fracture toughness of around 25. Alloys made in practice of this invention in the Zr-Ti-Cu-Ni-Be-Nb system with a second crystalline phase formed in situ have typical fracture toughnesses in the order of 40 to 45.

Dr. Johnson has described the Mg-Cu-Y materials, either amorphous or as an amorphous matrix with a crystalline embedded phase, as "window-glass brittle". He has also described an amorphous metal matrix composite in the Zr-Ti-Cu-Ni-Be-Nb system as having a fracture toughness like "beat-it-with-a-hammer-and-it-doesn't-break toughness".

As previously indicated, claim 1 has been amended to recite a ductile composite. A ductile composite requires a ductile amorphous phase. The amorphous phase in the Liu paper is not ductile nor is the composite ductile. The lack of ductility of the materials described is not mentioned in the Liu paper (failure to mention an undesirable property is understandable). Absence of any mention of ductility is immaterial.

> "From the standpoint of patent law, a compound and all its properties are inseparable; they are one and the same thing. . . . And the patentability of the thing does not depend on the similarity of its formula to that of another compound but of the similarity of the former compound to the latter. There is no basis in law for ignoring any property in making such a comparison. An assumed similarity based on a comparison of formulae must give way to evidence that the assumption is erroneous." *In re Papesch* 315 F.2d 381 (391) 137 U.S.P.Q. 43 (51) CCPA (1963).

The ductility of the amorphous phase in the materials disclosed in this application is specifically mentioned (in the paragraph bridging pages 1 and 2, for example). The ductility of the composite is specifically mentioned in the description (in the first sentence of the DESCRIPTION on page 3, for example).

It is unknown whether the Mg_7Li_3 precipitated nanocrystals mentioned by Liu are ductile. The grain size of the precipitate is only about 10-20 nanometers (Liu paper page 2388, 2nd Col.) and they are embedded in a brittle amorphous matrix, hence, they have not been measured.

Whether or not they are ductile is immaterial since the matrix is brittle and the composite is, therefor, brittle.

Thus, the Liu paper does not disclose a ductile reinforced amorphous metal composite. A rejection under 35 U.S.C. §102 is inappropriate. Furthermore, there is nothing in the Liu paper in any way suggesting formation of a ductile composite by in situ precipitation of a ductile crystalline phase. Claim 1 and the claims dependent from it should therefore be allowed.

Re-examination, reconsideration and allowance of this application are respectfully requested. It is considered that all of the claims are in condition for allowance. If there are additional issues, it is requested that a telephone call be placed to the undersigned instead of or before issuing a final rejection. It is our experience that such telephone interviews are quite useful for identifying and resolving issues, thereby leading to early disposal of applications.

Respectfully submitted,

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